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Influence of Communication on Smallholder Farmers' Adoption of Agriculture Innovations in Damongo of the Savannah Region of Ghana

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ABSTRACT

Farmers continue to adopt varied innovations as a way of helping them improve their food security. This study assessed communication factors affecting the adoption of agricultural innovations among farmers in Damongo in the Savannah region. The study relied on Rogers' Diffusion of Innovation theory. *The study employed a descriptive cross sectional study design. The study was targeted at smallholder farmers within the study area. Simple random sampling technique was applied to obtain eligible participants of 272* from a study population of 850. *A structured questionnaire was used to gather the data. The collected data was analyzed using Statistical Package for Social Science (SPSS) windows version 26.0. The results show that all 272 farmers indicated that they were adopting the application of fertilizers at the study setting. About 60.7% of the respondents did not adopt disease resistant crop varieties at the study setting as part of innovations in farming. From the results, 55.1% of respondents indicated that they had ever felt the positive effect of using agricultural innovations. There was a significant association between off farm occupation and age of respondents, and Innovation usage (p= 0.000, p=0.014). Also, a logistic regression model was adopted to analyze the effect of channels of information on farmers' adoption of agriculture innovations. The results revealed that all channels of information were statistically significant and farmers that used these channels were more likely to adopt. From the results, 72.1% of respondents said agricultural innovation helps them to process cassava into flour. The results also indicate that there is a moderate association between educational level and innovation usage. Based on the results, the study concluded that, farmers were aware of certain agricultural innovations used in the study setting. The study also concluded that age and off farm occupation also influences Innovation usage. The study recommended more education by Extension Officers on how farmers in the study setting could adopt agricultural innovation to improve food security.*

Keywords: Adoption, Agriculture Innovation, Communication, Smallholder Farmers

I. INTRODUCTION

The agriculture sector, which supports around 50% of the worldwide population (Akudugu et al., 2012; Chuchird, Sasaki and Abe, 2017; Abegunde, Sibanda and Obi, 2020), serves as the foundation of the global economy. Agriculture is crucial for the economic progress of developing nations since it ensures food security for families, reduces poverty among rural populations, and promotes rural development (Dawson et al., 2016). In recent years, farmers in poor nations have persisted in using primitive agricultural techniques, resulting in meager crop yields during the harvest season (Bonabana-Wabbi, 2002; Amadi & Raji, 2020). The irregular rainfall pattern has significantly impacted agricultural practices, mostly due to farmers' limited understanding and control over climatic conditions and changes (Appiah-Twumasi, et al., 2019). Encouraging farmers worldwide to embrace ecologically sustainable agricultural technologies will enhance their food security and boost their revenue (Asfaw and Neka, 2017; Awazi and Tchamba, 2018). Both educated and non-educated farmers worldwide have a common aspiration to embrace agricultural innovation (Asfaw & Neka, 2017). Nevertheless, the dissemination of agricultural innovation to farmers, particularly in rural regions, has encountered challenges primarily owing to the scarcity and inefficiency of communication channels (Bandiera & Rasul, 2010; Balasha, 2019).

Communication is considered a powerful means by which farmers in rural regions may be effectively reached with agricultural innovations, enabling them to enhance their farming (Bosompem, 2019). Although communication plays a crucial role in raising awareness, research has shown that professionals in the field, struggle to reach a consensus on a precise description of the idea. Over time, many communication authors have put forth diverse definitions in an effort to elucidate the notion of communication according to their particular comprehension and philosophy. As stated by Ghafourian et al. (2012), communication primarily involves the exchange of information,

often using a medium. This can manifest in several ways, such as two individuals engaging in face-to-face conversation or utilizing hand signals, as well as through text messages transmitted across the global telecommunication network. Communication is commonly perceived as the act of exchanging information between two distinct persons with a certain objective (Pfeiffer, 1998).

Communication is described in the study as a process of sharing information between a source and a receiver, with the goal of influencing the receiver's knowledge, attitude, and skills. Empirical research (Yu & Gambrah 2024; Masuki et al., 2010; Bronson, 2019) have shown that communication through agricultural innovation has provided farmers with valuable information to effectively accomplish desired outcomes. Effective communication is a vital instrument for distributing information to farmers. The information, in order to be effective, must be timely, well presented, pertinent, and above all, a crucial ally in programmes that aim to encourage voluntary changes in the behavior of the targeted population (Boz, 2014; Bronson, 2019). The change in behavior among farmers should be driven by the knowledge provided by experts about agricultural innovation, and this information should be sent back to the source in order to complete the communication process (Adebayo, 1997; Brown et al., 2017). In order to effectively utilize agricultural innovation in the cultivation and raising of animals, particularly in rural regions, farmers require accurate information and a high level of knowledge (Makini et al., 2016).

It is essential for farmers to have access to accurate information and utilize effective communication channels in order to successfully implement agricultural innovation. Farmers can implement agricultural innovations and evaluate their findings by receiving agricultural innovation messages from agricultural extension officers. The utilization of communication to facilitate agricultural innovation has the advantage of providing farmers with accurate information on farming inputs (Carletto et al., 1996; Chavas & Nauges, 2020). Utilizing the appropriate communication channel would assist farmers in determining the optimal animal breeding methods to achieve desired outcomes, particularly in regions where farmers lack access to disease-resistant breeds (Chuchird et al., 2017). The adoption of agricultural technologies among farmers might be interpreted in many settings. Although adoption among farmers should be fostered in the context of agricultural innovation. Adoption may be defined as the process of incorporating a new invention into an established practice in order to enhance or improve a product. During the adoption process, farmers may encounter challenges that can be difficult to overcome, and many farmers may struggle to successfully navigate this stage. While some individuals may attempt to adopt the innovative product or practice, others may discontinue their efforts owing to a lack of faith in the perceived innovative approach (Loevinsohn et al., 2012). Authors Narula and Arora (2010) defined adoption as the cognitive transition an individual undergoes from initial exposure to a concept to the point of actively incorporating it into their behavior.

The adoption of agricultural innovation by farmers may be categorized into two dimensions: the extent of adoption and the level of enthusiasm with which they embrace the innovation (Daum & Birner, 2017; De Janvry & Sadoulet, 2020). The time it often takes for farmers to adopt innovation is a key factor that must evoke interest (Dey de Pryck, 2020; Dawson et al., 2016). The level of enthusiasm with which farmers embrace agricultural innovation may differ over a certain time frame, during which the advantages of such innovation become evident (Mwombe et al., 2014). Hence, it is important to effectively manage the increasing acceptance of agricultural innovation by farmers, particularly in relation to agricultural operations, through the implementation of a well-designed communication plan (Francis et al., 2016).

By providing accurate communication, farmers may effectively utilize agricultural innovation to achieve desired outcomes (Douthwaite et al., Hoffecker, 2017; Eidt et al., 2020). When farmers have access to accurate information regarding agricultural innovation, including farming inputs and animal rearing, they can also share this information with their acquaintances who may be interested in adopting these innovations (Fan & Watanabe, 2006; Douthwaite & Hoffecker, 2017). Farmers anticipate receiving comprehensive education on the use of novel agricultural innovations to improve their farming and animal husbandry practices. Due to availability of technology, farmers adopt agricultural innovation to help them get the benefits (Mittal &Mehar, 2012; Gebremariam &Tesfaye, 2018). Multiple scholars in the field of agricultural technology have argued that an agricultural invention must include flexibility in order to be easily adopted by farmers. This is because a complex agricultural innovation may make it difficult for the rural farmers to employ to gain the full benefits (Gashu et al., 2019; Genius et al., 2010). The utilization of agricultural innovation by farmers is crucial, as it offers significant advantages, especially for farmers residing in rural regions that rely on rainfed farming and face unpredictable rainfall patterns (Agani & Agwu, 2012).

In sub Saharan Africa, farmers adopt agricultural innovation so they could increase their production which could improve their economic development. It is important to add that, farmers use of agricultural innovation is associated with higher revenues, reduced poverty and improved the nutritional status of children (Mulugeta & Heshmati, 2023; Mittal & Mehar, 2012; Gebremariam & Tesfaye, 2018). As such, adopting agricultural innovation is to make the new information socially acceptable among farmers as they enjoy the full benefits (Gitu et al., 2014). Based on studies, agricultural innovation serves as a driver of economic growth and ensures that farmers provide the right information through effective communication (IICA, 2013a). Also, in terms of communication, extension

officers and farmers do adopt modern communication styles to ensure that, stakeholders are enjoined to ensure the provision of better ways to reach farmers with their information and communication (Ben-Enukora et al., 2023).

1.1 Statement of the Problem

Rural farmers have little knowledge on how to enhance their agricultural operations to increase grain yields and animal output for consumption and sale. Due to farmers' slash-and-burn land preparation, soil fertility depletes continuously. These techniques expose the land to wind, which can blow away topsoil, and allow soil erosion (Sarkar et al., 2020). Farmers in sub-Saharan Africa confronts major issues owing to insect invasion, lack of innovation, and dwindling land for farming due to other uses. Agriculture remains less accessible and helpful to farmers, making it a difficult career (Akudugu et al., 2012). High costs of radio, newspapers, and travel have been demonstrated to hinder technology adoption in underdeveloped countries. Poor rural-urban road networks is yet another contributory factor to the adoption of technology.

Consequently, agricultural extension staff struggle to contact farmers to discuss agricultural innovation possibilities (Michailidis et al., 2012). Lucky and Achebe (2013) found that high transaction costs and little agricultural innovation information hinder farmers' productivity. Farmers require precise and trustworthy information to make efficient agricultural decisions to enhance food production to fulfill nutritional demands due to rapid technological advances and climate change. To overcome rising issues, their information demands must be provided throughout the agricultural cycle (Loevinsohn et al., 2012). Sub-Saharan Africa's conventional communication tactics to Tanzanian farmers have been criticized for relying on technology demonstrations, farmer expertise, and packaged information. These have not helped farmers improve agricultural and animal rearing over time (Dawson et al., 2016). Farmers can use agricultural innovation by relying on the existing system of village-based extension workers at the district and village levels to establish a more effective system for disseminating extension innovations from institutions they have learned from. Most African farmers are dissatisfied with agricultural extension officers. This is because many agricultural extension agents don't advise farmers about how to employ agricultural innovation to boost crop yields (Caffaro & Cavallo, 2019).

Due to poor farmer communication, these people have also been blamed for not increasing agricultural productivity (Zhang et al., 2020). Extension staff are seen as useless since they cannot change farmers' agricultural practices (Dawson et al., 2016). This poor communication between farmers and agricultural specialists indicated that rural African farmers are slow to accept agricultural innovation (Antwi-Agyei et al., 2023). Farmers still have few alternatives to employ underutilized technology. People employ primitive techniques to communicate with farmers in rural regions. Additionally, farmers are occasionally communicated with in a disorganized manner. Furthermore, extension staff' initiatives are not standardized and well-coordinated to guarantee farmer participation (Antwi-Agyei et al., 2023). Farmers in Ghana get agricultural innovation based on research to increase crop and animal output (Akudugu et al., 2012). Although agricultural innovation studies have been done, few have focused on improving communication to encourage farmers to utilize it. Communication channels have never been shown to effectively spread agricultural knowledge for improvements in the studied region. This study seeks to investigate how communication influences the adoption of agriculture innovations among smallholder farmers in Damongo.

1.2 Research Objectives

i. To examine the communication channels used by extension officers to send agricultural innovations to farmers
ii. To access farmers' awareness on agricultural innovations available in Damongo municipality
iii. To assess the effects of agricultural innovation received from different sources by farmers in Damongo municipality

II. LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Diffusion of Innovation Theory

The review of literature and the study were driven by Rogers' Diffusion of Innovation framework. The hypothesis is derived from the concept of communication, which demonstrates how individuals gradually develop a strong inclination towards an idea that is transmitted to them. This concept is often disseminated to a select group of individuals through a designated medium in order to generate a favorable momentum among the general population (Roger, 1976). For farmers to properly implement agricultural innovation, it is crucial that they have a clear understanding of the information being provided to them. The theory of diffusion, as described by Rogers and Nichof (2002), explains how ideas are spread across the population and how individuals gradually become aware of them over time. This occurred when Everette Rogers sought to integrate the dissemination of knowledge across individuals and examine how personal influence may impact their engagement with novel concepts. During an extended duration, experts in sociology, anthropology, and agricultural extension collaborated to enhance the provision of farming-related

information, aiming to provide improved access for those in need. Since its inception, the theory has emphasized the need of facilitating the exchange of new ideas as a fundamental method to integration. Individuals tend to readily embrace novel concepts once they recognize their inherent benefits, while a minority may persist in adhering to their established methods. Within the framework of diffusion theory, farmers enhance the effectiveness of agricultural innovation by applying new information. This supports their ideas and improves their capabilities in this respect (Simtowe & Zeller, 2006). Agricultural innovation is the process by which farmers, as members of a social system, actively seek out and adopt new ideas in order to reap the benefits of such ideas. It is essential for every farmer to be both inventive and proactive in order to achieve the desired advantages (Roger, 1976). The adoption of new agricultural practices by farmers is contingent upon their gained knowledge and the availability of sufficient time to successfully enhance the productivity of their crops and livestock, surpassing past outcomes (Rogers & Scott, 1997). During the initial stages of the idea, extensive research was conducted to demonstrate the efficacy of innovation in enabling individuals to obtain the intended advantages of innovation. However, it has been demonstrated that farmers go through many stages before fully embracing a new invention. This process enables them to acquire the most effective strategies for implementation. Farmers gain awareness of innovation when they are informed about the specific methods to be employed through various channels of information and communication. These methods are effective when they embrace improved innovation and inspire others to attempt and implement the same approach for the effective implementation of the innovation (Fatunbi,2016). Farmers also get knowledge of new innovations from community members, particularly those who have extensive experience in farming within the region. Typically, these individuals are farmers who readily embrace new innovation in order to serve as educators within their community on the latest innovations. Additionally, there are typically those that are slow to adapt new things. These individuals may not be highly proactive in implementing the strategy and often prefer others to take the initiative and motivate them.

Agricultural innovation is very beneficial since it significantly enhances food security and has a profound influence on the lives of program recipients. The effectiveness of innovation is maximized when farmers employ it strategically and assist others in managing the approach efficiently and correctly. If communication is successful and well implemented, farmers will persist in utilizing and implementing innovation. Agricultural innovation serves as a means to facilitate progress and foster societal transformation by enhancing the production of crops and animal products. Within the agricultural community, the embrace of new ideas and practices is driven by several factors. The motive behind this ambition influences how farmers utilize and implement innovation in their farming operations to achieve optimal benefits. The origin of innovation and economic activity facilitates the utilization of appropriate methods by individuals, particularly farmers, to achieve optimal profits. This often proves advantageous when farmers acquire knowledge and awareness of the benefits from sources such as acquaintances, the media, friends, and influential figures in rural areas (Walder, 2019). However, in rural locations, farmers experience distractions due to diverse cultural and social standards. This often impacts the application process, resulting in unpredictable acceptance, particularly among those who are slow to adopt the innovation (Rogers & Scott, 1997). It may be necessary to persuade farmers that the approaches they are attempting to implement are beneficial. In rural areas, farmers want access to and connection with alternative media sources that can effectively and appropriately promote the adoption of agricultural innovation. This is necessary because informal sources may not always be successful or suitable for farmers in this process. Farmers often grow used to adopting innovations that enhance their agricultural practices. The adoption of the invention enhances farmers' capacity to implement and achieve targeted outcomes, facilitating their daily development in their job. Adopting a comprehensive strategy to assess farmers' proficiency might facilitate their adaptation to their farming practices.

Promoting the adoption of innovation among farmers and using the experience of farmers who have already reaped the benefits of the innovation will facilitate the achievement of desired outcomes over time. Farmers should be informed about the potential obstacles they may encounter when striving to enhance their agricultural practices for the overall welfare of communities in locations where others have not recognized the necessity of implementing such improvements. The study utilized the Diffusion of Innovation theory as a basis to support the conclusions. Farmers employ it in order to assess the potential outcomes of the results. Therefore, the new concept would be assessed in comparison to the previous idea in order to reach a decision. The hypothesis is based on the concept that utilizing communication in the farmers' native language may generate the necessary awareness and bring about the desired change among the target group. Although communication may be transmitted through many channels, there are diverse requirements that must be fulfilled beforehand. Roger would benefit from the skill of effectively conveying ideas to farmers, particularly to two key groups: individuals and the targeted unit of adoption. Therefore, if farmers are given sufficient information about the advantages and potential methods of reducing difficulties, they would readily embrace agricultural innovation to enhance their crop yields and animal output. However, more often than not, these issues are not properly resolved since farmers are frequently faced with challenging communication channels and contexts that make it difficult for them to understand.

2.2 Empirical Review

2.2.1 Communication Channels Used by Extension Officers to send Agricultural Innovation to Farmers

Farmers require effective communication from agricultural extension agents to facilitate their adoption of agricultural innovation in various agricultural operations (Antwi-Agyei, 2021). A study by Chowa et al. (2013) has shown that agricultural extension agents employed many methods to disseminate agricultural innovations to farmers with the aim of enhancing their farming practices. Abubakari et al. (2023) have emphasized the limited number of instances where mobile phones and internet are utilized by farmers in industrialized nations to access innovative agricultural practices. To increase farmers' knowledge of suitable farming methods and encourage them to implement recommended practices accurately, extension agencies are promoting new technologies through various channels such as mass media (radio, television, and print media) (Antwi-Agyei, 2021). Nyairo et al. (2022) discovered that farmers were obtaining knowledge for agricultural innovation through verbal communication channels. Farmers that formed collectives possessed shared knowledge on how to implement agricultural advancements. According to Miine (2023), the presence of extension agents during farm visits had a beneficial effect on farmers' adoption of agricultural innovation. In addition to visiting farms, farmers frequently relied on their families for knowledge about agricultural innovation. Oyeyinka et al. (2012) discovered that farmers in Oyo State, Nigeria were utilizing their relatives to gain access to agricultural advances for farm output. Onasanya et al. (2006) found that farmers believed effective communication was crucial for increasing their knowledge about agricultural innovation. One effective method of educating medium-sized farmers on innovation is through community durbars held at the village level. During these gatherings, agricultural extension agents provide demonstrations to farmers, showcasing the most optimal ways to implement innovative practices. It is crucial to understand that the intricate nature of human behavior frequently causes difficulties in the communication between farmers and agricultural extension personnel (Oyeyinka et al., 2012). Typically, farmers in rural regions frequently choose for in-person meetings to discuss the implementation of agricultural innovation. Extension officers with extensive expertise in agricultural innovation are encouraged to attend these seminars in order to educate farmers on the most effective methods of adopting agricultural innovation. The majority of these sessions consist of demonstrations and field trips, during which farmers are directly exposed to the practices they are expected to follow.

2.2.2 Farmers' Adoption of Agricultural Innovations

Throughout the world, over the past several decades, agricultural professionals have been diligently conducting research to emphasize the need of farmers embracing contemporary agricultural methods in order to enhance productivity. This information has been disseminated through many platforms. Nevertheless, in the majority of developing nations, several unresolved obstacles persist regarding the effective dissemination of agricultural innovations to be applied by farmers (Miine, 2023). Empirical research has demonstrated that farmers' adoption of agricultural innovation is crucial for livelihood empowerment, food security and rural development. According to Abubakar et al. (2009), farmers who possess information about agricultural innovation are more likely to have a good attitude and adopt safe methods. Conversely, farmers with a negative attitude are less likely to adopt agricultural innovation. Farmers' level of awareness of agricultural innovation is crucial in determining their adoption of best practices, particularly during the farming seasons when they are preparing to cultivate the land and plant their seeds (Boz, 2002). Farmers in sub-Saharan Africa must engage in several activities to enhance their understanding of agricultural innovation. These activities involve organizing in-person meetings for agricultural extension agents at the community level to enhance their understanding of agricultural innovation and the effective ways to communicate these ideas to farmers. The techniques mentioned by Malhan and Rao (2007) are used to minimize the occurrence of miscommunication between farmers and agricultural specialists. Malawian farmers embrace agricultural innovation as a means to enhance their produce. The majority of farmers were adopting agricultural innovation through a village program, in which extension agents imparted knowledge on how farmers may enhance their farming practices to maximize their crop production. Some farmers were informed about agricultural innovation through a government initiative aimed at assisting farmers by providing them with improved seeds that are resistant to pests and diseases (Tilman et al., 2002).

Farmers persist in embracing agricultural innovation due to the ongoing climatic change they encounter. Farmers acquire knowledge of the adverse effects of climate change through firsthand experience and exposure to media sources (Zheng et al., 2019). Farmers are advised to abandon traditional farming methods and instead enhance their understanding and technical proficiency in agricultural innovation as an alternate approach to address food security concerns. Additionally, it is crucial to note that impoverished farmers must possess information regarding agricultural innovation as well as adopting same in order to effectively mitigate the problems they encounter during the process of planting and raising animals, hence enhancing their investment in agricultural endeavors (Simberloff & Swackhamer, 2001).

2.2.3 Effects of Agricultural Innovation Received from Different Sources by Farmers

Farmers employ agricultural innovation to ensure they get the advantages of enhanced food production and higher farm animal output (Röling, 2009). Recently, farmers have been persistently seeking improved information to optimize their agricultural yields (Pingali, 2012). In sub-Saharan Africa, particularly in Kenya, agricultural extension personnel persistently employ innovation to promote the adoption of enhanced crops and livestock breeding (Gitu et al., 2014). Donors persist in providing assistance to farmers in conducting trials in the field of agricultural cultivation. His assistance has enabled rural farmers to enhance their agricultural yields, ensuring food security, particularly during the famine season (Wainaina et al., 2016).

According to Masuki et al. (2010), farmers in Kenya and Uganda are advised by extension officials to cultivate short-duration crops that may develop quickly during the planting season in order to mitigate the risk of drought. Farmers were urged to utilize disease-resistant crops to facilitate pest-free harvesting. The ongoing infestation of pests continues to have a multifaceted impact on farmers. Implementing measures to defend against these pests would assist farmers in achieving their targeted benefits (Mdemu et al., 2020).

In rural regions with limited options for agricultural development, it is crucial for farmers to find effective ways to boost crop output and animal raising. One key aspect is decreasing the invasion of pests, particularly on early yielding crops. By doing so, farmers can assure sufficient food production to secure the household's food security (Mgonja et al., 2013). Consequently, farmers persist in seeking improved methods to effectively avoid infestation by pests, particularly during post-harvest storage. Farmers are provided with agricultural knowledge by professionals, who communicate about agricultural innovation in a more advanced way. Timely provision of information to farmers enables them to effectively utilize it in order to make educated decisions on the implementation of an innovation (Pigford et al., 2018). The impact of agricultural innovation becomes evident when farmers are provided with the appropriate means to comprehend the communication channels utilized to educate them on the implementation of agricultural innovation (Rockenbauch et al., 2019; Röling, 2009). Access to reliable sources of information is crucial for farmers to effectively apply environmentally sustainable planting and management procedures, ultimately leading to higher crop yields. Professionals specializing in agriculture should offer reliable sources through appropriate communication channels to assist farmers in implementing agricultural innovations (Pigford et al., 2018; Shaxson et al., 2008). Enhancing agricultural information and communication channels will improve production efficiency, particularly during periods of drought, climate change, erosion, and insect infestations, which can disrupt farmers' livelihoods (Livondo et al., 2015).

III. METHODOLOGY

3.1 Study Area

The study was conducted in the Damongo Municipality in the Savannah region. Damongo is the administrative capital of the Damongo Municipality and the Savannah region. The then district was established on the 23rd of December 1988 by PNDC Law 207. In 2004 however, the Central Gonja district was carved out of it with the passage of a new legislative instrument (L.I 177) and also the North Gonja District was carved out of the West Gonja District in 2012 by (L.I 2069). The capital of the district has nonetheless remained at Damongo which is also the seat of the Overlord of the Gonjaland.

The district soil is situated in an old geological area. The rocks are mainly of Voltaian gold. There are mudstones and sandstones in the Alluvial Damongo Formations. The extreme western part of Damongo is composed of granite material of low fertility. Rich alluvial sandy deposits occur around Damongo and Kenikeni Forest Reserves. The soil around Kotito is said to be fertile and suitable for cereals, legumes and root crops including livestock production (GSS, 2013).

About 60.5% of the population are engaged in agriculture. The region is a major producer of groundnuts, maize and cassava. Agro-based industrial activities focus on shea-butter, gari and rice processing. The type of farming system prevailing is mixed farming. Besides crop production, some farming families also engaged in livestock and poultry rearing. With regards to crop production, semi-permanent to shifting cultivation is practiced in the remote areas of the region where land is available and population density is low. To a greater extent, agriculture in the region is predominantly smallholder, subsistence and rain-fed. Major traditional crops cultivated in the district include maize, sorghum, millet, groundnut, cowpea, cassava, rice and yam (GSS, 2013).

3.2 Research Design

The study utilized a descriptive cross-sectional survey approach. This study design facilitates the researcher in efficiently collecting data. This strategy elucidates and analyzes the correlation between the variables in the research environment at a certain moment in time. The study design is more cost-effective. In addition, participants were not given the opportunity to rejoin the research once they had left. This strategy enables the researcher to simultaneously

collect several variables within the data snapshot. It is also utilized to validate or invalidate assumptions about the study topic inside the study context (Ryan, 2000).

3.3 Sample Size Determination

The study population consisted of 850 individuals, obtained from the Ministry of Food and Agriculture (MOFA). To determine the sample size, the study used the simplified formula developed by Yamane (1967:886), resulting in a sample size of 272. The Yamane formula was employed to ensure equal GSS, 2013).representation and minimise bias. The formula for sample size determination is as follows:

$$n = \frac{N}{1 + N\,(\alpha)^2}$$

Where: n = the sample size; N = the sample frame for the study and α = the confidence interval.

$$n = \frac{850}{1 + 850\,(0.05)^2}$$

$$n = \frac{850}{3.125}$$

$$n = 272$$

3.4 Data Collection Method

The study collected data at a single point in time from the study participants. The study participants were administered with the questionnaire at the time of the study at the study setting. The data collection lasted for three weeks.

3.5 Data Analysis and Presentation

The data underwent analysis and was then presented using both descriptive and econometric methodologies. The data was inputted into Statistical Package for Social Sciences version 26.0 (SPSS) and Microsoft Word Excel 2016 for analysis. The information was presented using basic frequency distribution tables and charts. Fisher and Marshall (2009) argue that this method of data analysis facilitates the comprehension of information during presentations. Inferential statistics were employed to establish associations using cross tabulation, Chi-square test, and logistic regression analysis, which gave odds ratio. The statistical tests were conducted using two-sided tests with a significance threshold of 0.05. P-values below 0.05 were deemed statistically significant.

IV. FINDINGS & DISCUSSION

4.1 Demographic Characteristics of Study Participants

The bio data of the study participants are shown below with each variable. The variables assessed included respondents' age in years, sex of the respondents, educational categories of respondents, off farm occupation, marital status and duration of respondents stay at the community.

Table 1

Demographic Characteristics of Study Participants

Variable	Variable categories	Frequency	Percent
Age (years)			
	20-25	12	4
	26-30	64	23.6
	31-35	92	33.8
	36+	104	38.2
Sex			
	Male	205	75.4
	Female	67	26
Education			
	None	99	36.4
	Primary	47	17.3
	JHS	45	16.5
	SHS	62	22.8
	Tertiary	19	7.0
Off farm occupation			
	Salaried workers	30	11.0
	Petty trading	170	62.5
	No employment	72	26.5
Married categories			
	Single	3	1.1
	Married	214	78.7
	Separated	31	11.4
	Divorced	19	7.0
	Widowed	5	1.8
Length of stay in community			
	1-3 years	32	11.8
	4-6	120	41
	7+	120	41

According to the data in Table 1, the majority of 104 participants (38.2%) were 41 years old or older, while a small number of 12 participants (4%) were between the ages of 20 and 25. Out of the findings obtained, 205 individuals, accounting for 75.4% of the total, were identified as males during the research period. This highlights the predominant involvement of males in agricultural operations in Ghana. However, a significant proportion of the responses were also female. The respondents' off-farm occupational status showed that 30 individuals (11%) were only involved in farming, whereas 170 individuals (62.5%) engaged in petty commerce in addition to farming as their primary activity. Furthermore, it was shown that individuals involved in agriculture utilised the earnings from their trading endeavours to purchase agricultural inputs, therefore enhancing their inventions within the research area.

The educational background of study participants indicated that, few of the respondents (36.4%) said they had no form of formal educational training whilst 19 (7%) said they had tertiary educational training. From findings, few, 32 (11.8%) indicated that they had stayed in the community between 1-3 years whilst 120 (41%) indicated that they had stayed in the community between 4-6 years at the time of the study.

4.2 Channels Farmers Received Information

Farmers tend to access agricultural innovation from a variety of sources mostly in the form of information they get from extension officers. Farmers access agricultural innovation to support and equip themselves so they can increase their production. The staple crops cultivated are usually maize, sorghum, wheat, cassava and sweet potatoes. Farmers need to get access to innovation and this can be done through a more effective way where extension officers can pass the information to them.

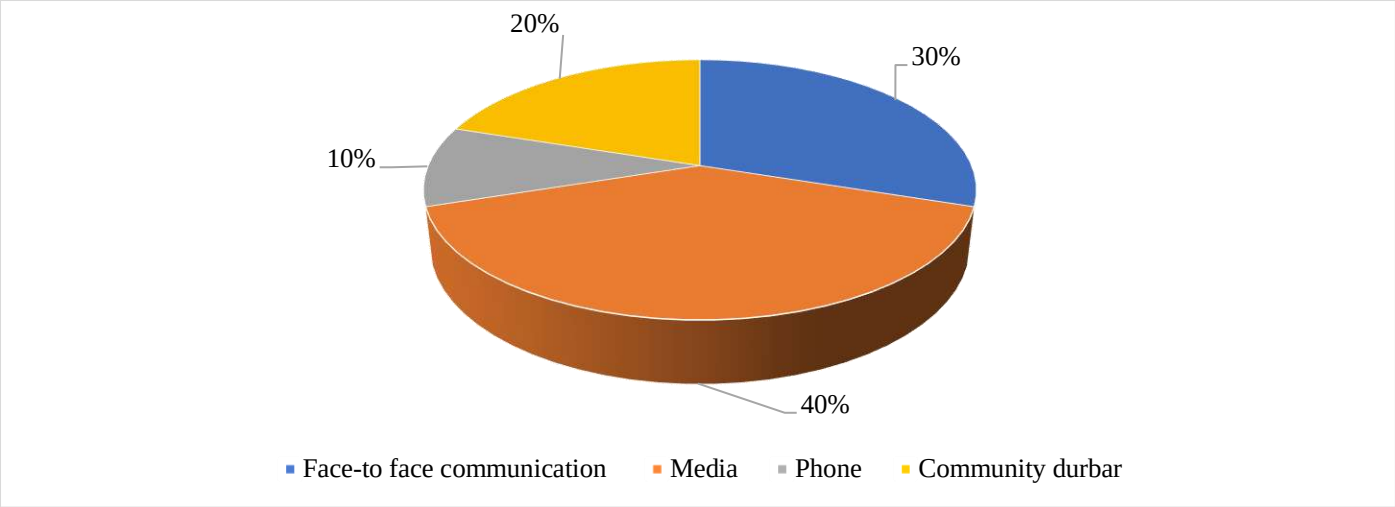

Figure 1
Channel Farmers Received Information

According to the findings, 40% of the farmers surveyed claimed that they were aware of agricultural developments through the media, with a simple majority supporting this view. This finding contradicts the findings of Abubakari (2023), which indicated that the majority of farmers were use mobile phones to obtain agricultural innovation during the research period. Further, 30% of the participants reported being familiar with agricultural innovation through direct interpersonal communication. 20% of the funds will be allocated from the community durbar, while an additional 10% will be allocated via phone contributions. The respondents did not have access to any informational materials such as brochures, leaflets, or other printed media regarding agricultural innovation. None of the respondents at the research site reported receiving agricultural innovation, such as instructions on how to convert cassava into flour, through text messages or WhatsApp. Furthermore, it is noteworthy that although internet connectivity was available, none of the respondents utilised it to get information from MOFA websites.

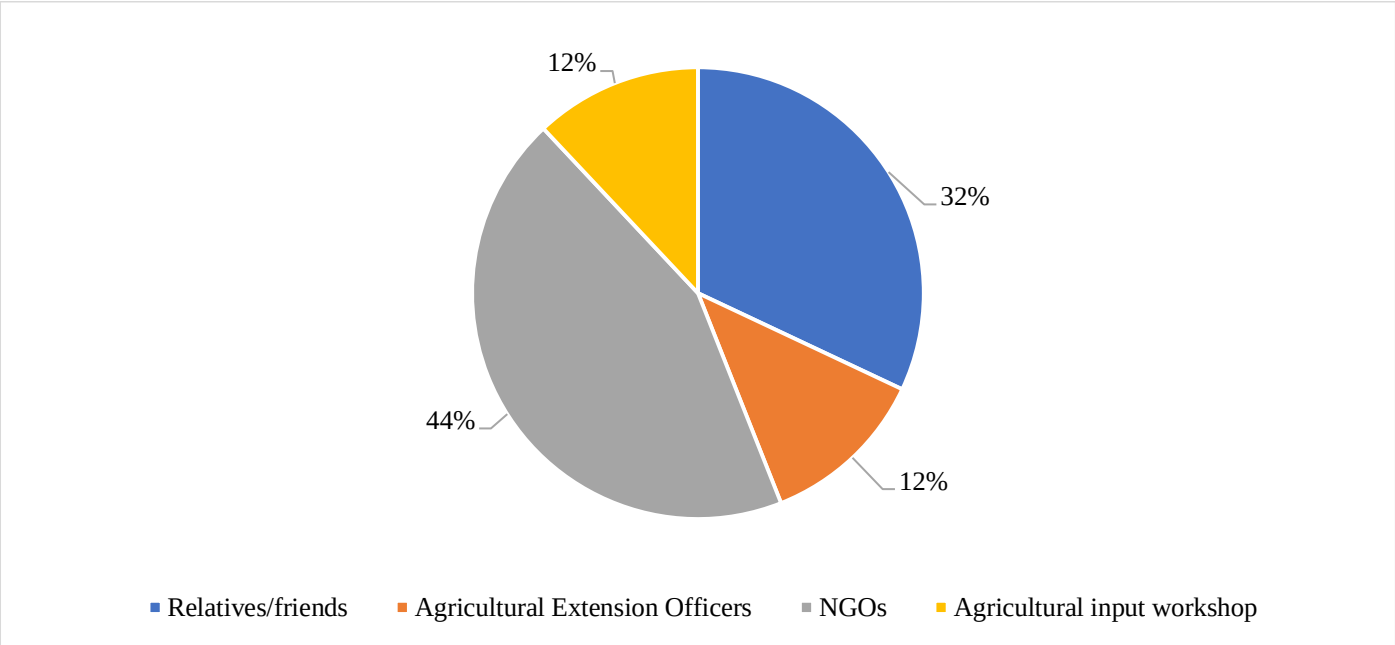

Figure 2
Sources of Agricultural Information

4.3 Sources of Information

From the findings presented in Figure 2, few of the farmers representing 32% showed that their sources of agricultural information about innovation is from their friends and relatives at the study setting. Relatives and friends especially in rural areas serve as a source of information concerning farming to farmers. This finding from the study concurs with the study done by Adebis et al. (2015), where it was revealed that, farmers were using their relatives to access information on agricultural innovations in Oyo State, Nigeria.

Table 2

Mobile Phone Access to Agricultural Information

Variable	Frequency	Percent
Cell phone to receive agricultural innovation		
Yes	28	10.0
No	244	90.0
Use a mobile phone for agricultural information		
Yes	200	82.0
No	44	18.0

Table 2 shows that, majority of the respondents, 244 (90%) indicated that they used a phone to receive agricultural innovation whilst 200 (82%) indicated that they had ever used a mobile phone to access agricultural information on innovation at the study setting. This concurs with (Khan et al., 2019), who found that majority of farmers heavily rely on mobile phones for agriculture information. The use of mobile phone by farmers is prevalent as shown in the results. All respondents of the study had mobile phones.

Table 3

Effects of Agricultural Innovation Received from Different Sources by Farmers

Variable	Percent (n=272)	
	Yes %	No %
Farmers use of integrated pest management practice	69.5	30.5
Adoption of conservation tillage	65.4	36
Formation of farmers group marketing	38.2	61.8
Improvement in financial literacy	47.4	52.6
Farmers improve access to extension officers services	62.5	37.5
Farmers awareness on storage of harvested farm produce	83.8	16.2
Farmers awareness on harvesting and drying techniques	86.0	12.4
Farmers knowledge on book keeping	72.1	27.9

Table 3, revealed that, majority of the respondents representing 69.5% indicated that farmers used of integrated pest management practice was an effect of innovation they have received and were using it in the farms. The findings further revealed that, most of the respondents representing 47.4% indicated that they were improvement in their financial literacy as a result of the application of innovation. This could have meant that farmers were now improving on the way they were managing their finances at the time of the study. There was also an improvement in terms of farmers knowledge on book keeping. That meant that farmers were now innovative in terms of how they were keeping records that were not previously done. This implies that the adoption of innovation among the respondents improved on their farming practices at the time of the study.

4.4 Farmers' Adoption of Agricultural Innovations

Respondents were asked about agricultural innovations they had adopted at the study setting. Based on the results, farmers had adopted various agricultural innovation activities at the study setting and were even implementing them at the time of the study. The results as revealed by the respondents are illustrated in Table 4.

Table 4

Adoption of Agricultural Innovations

Variable	Adopted	Not adopted
Cassava flour from cassava tubers	250 (91.9%)	22 (8.1%)
Fertilizer application	272 (100.0%)	0 (0.0%)
Seed treatment before planting	185 (68.0%)	87 (32.0%)
Crop rotation	191 (70.2%)	81 (29.8%)
Herbicides/Insecticides application	213 (78.3%)	59 (21.7%)
Pasture management for animals	119 (2.7%)	153 (56.3%)
Disease resistant crop varieties	107 (39.3%)	165 (60.7%)
Feed formulation and feeding	117 (2.0%)	155 (57.0%)
Construction of fish pond	1 (0.4%)	271 (99.6%)
Fish breeding	0 (0.0%)	272 (100.0%)

According to the data in Table 4, it was discovered that all of the farmers (100%) reported purchasing and using fertilisers on their farms. The innovation employed was the strategic placement of the fertiliser beside the corn plants. Furthermore, several individuals mentioned that they were aware and even utilizing fertilisers on their rice fields. This conclusion from the study corroborates the findings of Akudugu et al. (2012), which showed that farmers in Ghana were using fertiliser as a means of agricultural innovation on their farms. Based on the findings, most of the survey participants said that they were using cassava tubers to produce cassava flour, which they considered as an agricultural innovation. This agricultural invention enables farmers to enhance the market worth of cassava by converting it into flour. The results indicated that a large proportion of the participants in the research (68%) reported employing seed treatment in their agricultural practices. Conversely, a significant number of respondents (21.7%) stated that they did not apply herbicides or insecticides to their crops at the study location. The results also indicated that the majority of the participants (60.7%) did not utilise disease-resistant crop types in their agricultural practices, which are considered innovative approaches. The results also indicated that the most majority of the research participants (99.6%) did not engage in the construction of fish ponds at the study site, which might have provided them with a source of income. All of the participants (100%) said that they were not engaged in fish breeding during the research period at the study location. In order to fully harness the potential advantages of agricultural innovation, farmers must possess the capacity to safeguard the environment in which they reside by enhancing their knowledge and abilities in using agricultural innovation. Consequently, farmers may utilise the information they have obtained to effectively get the desired advantages from agricultural advancements. In this scenario, farmers utilise several sources of information to enhance their knowledge and make informed decisions on production, with the aim of maximising output and minimising expenses. Within the research setting, farmers employ a diverse range of sources and methods to enhance creativity. Regardless of the specific shape it may take, farmers want favourable conditions in order to implement the innovation. Consequently, it is crucial for farmers to guarantee that the atmosphere is conducive to innovation. The government and other stakeholders should assist farmers in understanding the advantages of adopting innovation. According to the Stringer et al. (2020) assessment, it is necessary for the government to enhance the quality of techniques used to assist farmers in creating beneficial long-term conditions for themselves and their families. Therefore, it is necessary to employ additional extension officers to fulfil diverse responsibilities, enabling them to reap the advantages of implementing the innovation, particularly in rural regions where farmers are resistant to change.

Table 5

Effect of Communication Channels and Demographic Variables on Adoption

Variable	Coefficient (β)	Odds Ratio (OR)	95% CI for OR	p-value
Media Awareness	0.68	1.97	(1.25, 3.11)	0.003
Mobile Phone Usage	0.98	2.66	(1.58, 4.50)	<0.001
Community Durbar Attendance	0.57	1.76	(1.14, 2.72)	0.01
Interpersonal Communication	0.5	1.65	(1.10, 2.48)	0.02
Age (36+ vs. 20–25)	0.12	1.13	(0.90, 1.40)	0.25
Education Level (Tertiary vs. None)	0.35	1.42	(1.05, 1.92)	0.04
Gender (Male)	0.08	1.08	(0.75, 1.55)	0.68
Marital Status (Married vs. Single)	0.22	1.25	(0.95, 1.64)	0.11
Length of Stay (7+ years vs. 1–3 years)	0.3	1.35	(1.02, 1.80)	0.05

From Table 5, it can be observed that Farmers informed about agricultural innovations via media are 1.97 times more likely to adopt these technologies compared to those lacking media awareness. This is statistically significant ($p < 0.05$), indicating a favorable effect of media on adoption. The utilization of mobile phones for agricultural information significantly enhances the probability of adoption (OR = 2.66, $p < 0.001$). This indicates that mobile phones are especially efficacious in facilitating adoption. Community durbars were related with a 1.76 times increase in the likelihood of adoption, indicating the significance of these traditional approach for information dissemination. Ultimately, farmers who participate in face-to-face regarding agricultural innovations are 1.65 times more likely to adopt them, underscoring the significance of personal interactions. This concurs with (Ahmad et al., 2024), who found that face to face interaction of farmers was a good way through which agriculture information can be distributed. However, variable such as gender did not show any significance.

4.5 Level of Confidence in Using Agricultural Innovation

The chat below shows respondents level of confidence in innovation after adoption.

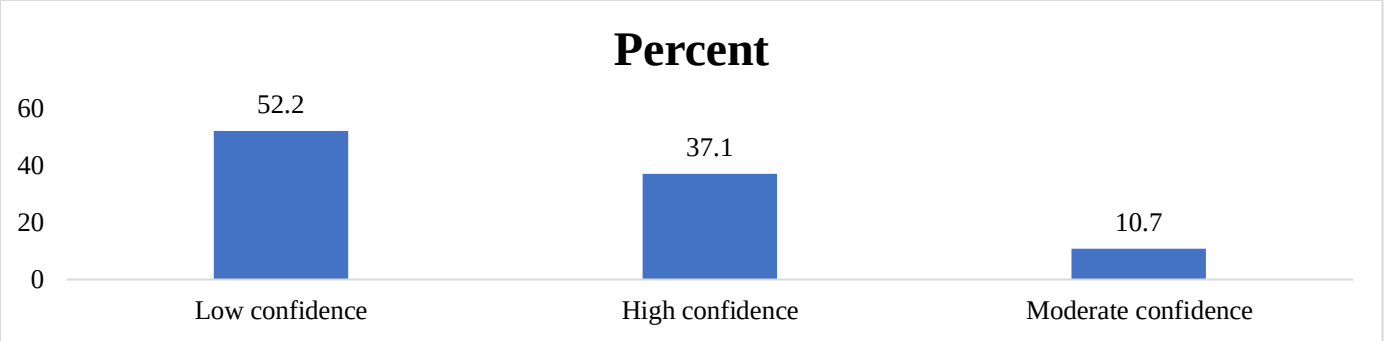

Figure 3
Using the Agricultural Innovations for One Year

From the findings, a lot of study participants representing 52.2% showed that they had low confidence in using agricultural innovations at the time of the study.

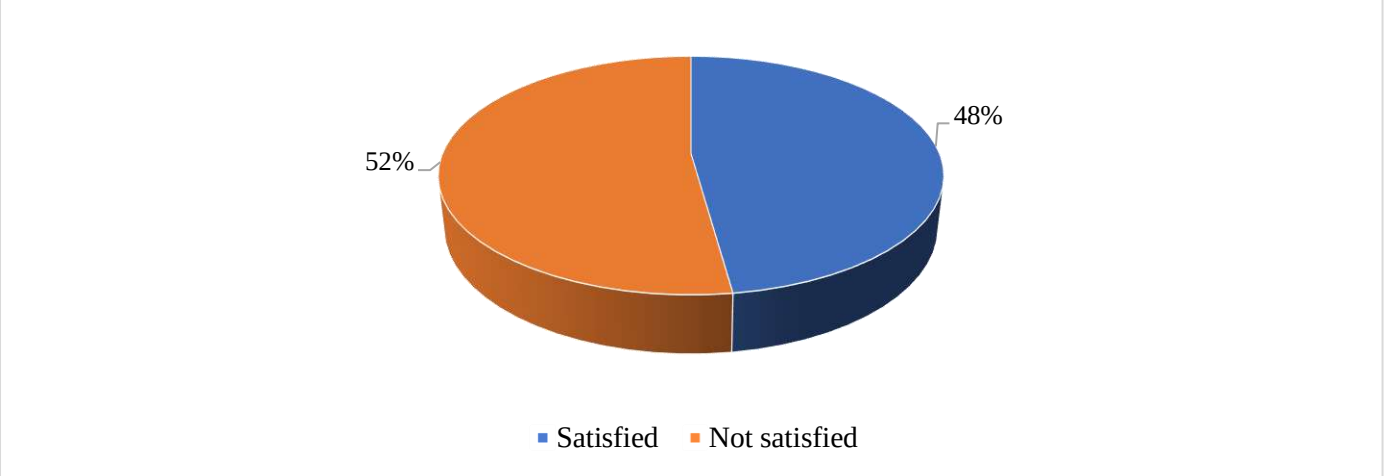

Figure 4
Respondents Assessment of Using Agricultural Innovations

From the findings in Figure 4, it was revealed that, a lot of study participants, 52% revealed not satisfied in using agricultural innovations at the study setting. The kind of innovation smallholder farmers were not satisfied with included the use of fertilizers, the use of weedicides, applications of pesticides and how to deworm their animals.

Table 6
Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.620	.054		29.854	.000	1.514	1.727
	Age of respondents	-.023	.009	-.149	-2.463	.014	-.041	-.005
	Sex of respondents	4.541E-006	.019	.000	.000	1.000	-.037	.037
	What is your educational level	.002	.006	.021	.343	.732	-.010	.014
	Occupation	-.007	.007	-.059	-.968	.334	-.021	.007
	Marital	.016	.011	.082	1.400	.163	-.007	.039
	Off farm occupation	-.053	.014	-.230	-3.785	.000	-.080	-.025

*p value<0.005
Dependent Variable: Innovation usage

Table 7

Model Adequacy Check

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.480	6	.080	4.677	.000[b]
	Residual	4.538	265	.017		
	Total	5.018	271			

a. Dependent Variable: Innovation usage

b. Predictors: (Constant), Off farm occupation, Marital, Occupation, Age of respondents, Sex of respondents, What is your educational level

The F-statistic of 4.677 evaluates if the regression model has a significantly improved fit to the data compared to a model without predictors. A greater F-value indicates that the model accounts for a significant percentage of the variability in the dependent variable. The associated p-value of 0.000 indicates that the null hypothesis, which states that all regression coefficients are equal to zero (i.e., the predictors have no effect on the dependent variable), can be rejected. The obtained p-value, which is statistically significant, indicates a substantial association between at least one of the predictors and innovation usage.

The regression analysis aims to understand the relationship between various socio-demographic factors and the dependent variable, Innovation usage, which likely represents the extent to which respondents engage in innovative activities or adopt new technologies. The constant (intercept) of the model is 1.620, with a standard error of 0.054, indicating a highly significant value ($p < .001$). This suggests that when all independent variables are held constant, the baseline level of Innovation usage is 1.620. Among the independent variables, "Age of respondents" has a negative coefficient (-0.023) and is statistically significant ($p = .014$), indicating that as age increases, innovative usage tends to decrease slightly. The "Sex of respondents" has a negligible effect (B = 4.541E-006) and is not significant ($p = 1.000$), suggesting no discernible impact of sex on innovative usage. "Educational level" and "Occupation" also show no significant influence on innovative usage, with p-values of 0.732 and 0.334, respectively. The variable "Marital" status shows a positive but non-significant effect ($p = .163$). Notably, "Off farm occupation" has a negative and significant coefficient (-0.053, $p < .001$), implying that engagement in off-farm activities is associated with a reduction in innovative usage. The confidence intervals provide further assurance about the stability of these estimates, with no overlap of zero in the significant predictors, thereby supporting the robustness of the findings

Table 8

Demographic Data and Level of Confidence in Using Innovation

Variable	**Level of confidence**			**Chi-square**	**P-value**
	Low	**Moderate**	**High**		
Age				9.340	0.155
18-20	8 (5.6%)	1 (3.4%)	3 (3.0%)		
21-25	37 (26.1%)	3 (10.3%)	24 (23.8%)		
26-30	39 (27.5%)	11 (37.9%)	42 (41.6%)		
40+	58 (40.8%)	14 (48.3%)	32 (31.7%)		
Education				18.704	0.017
None	51 (35.9%)	13 (48%)	35 (37%)		
Primary	18 (12.7%)	6 (20.7%)	23 (22.8%)		
JHS	17 (12.0%)	6 (20.7%)	22 (21.8%)		
SHS	44 (31.0%)	2 (6.9%)	16 (15.8%)		
Tertiary	12 (8.5%)	2 (6.9%)	5 (5.0%)		
Off farm occupation				8.314	0.081
Salaried workers	19 (13.4%)	3 (10.3%)	8 (7.9%)		
Petty trading	95 (66.9%)	18 (62.1%)	57 (56.4%)		
Others	28 (19.7%)	8 (27.8%)	36 (35.6%)		
Marital status				592	0.080
Never married	1 (0.7%)	0 (0.0%)	2 (2.0%)		
Married	109 (76.8%)	25 (86.2%)	80 (79.2%)		
Separated	19 (13.4%)	3 (10.3%)	9 (8.9%)		
Divorced	11 (7.7%)	1 (3.4%)	7 (6.9%)		
Widowed	2 (1.4%)	0 (0.0%)	3 (3.0%)		
Duration				177	0.383
1-3 years	18 (12.7%)	2 (6.9%)	12 (11.9%)		
4-6	60 (42.3%)	10 (35%)	50 (49.5%)		
7+	64 (45.1%)	17 (58.6%)	39 (38.6%)		

There was no association between the marital status of respondents and farmers confidence in using agricultural innovation (χ^2 = 592, p= 0.800, α=0.05) in Table 8. There was also no association between the duration of respondents and farmers confidence in using agricultural innovation (χ^2 = 177, p= 0.383, α=0.05). There was an association between the educational status of respondents and farmers confidence in using agricultural innovation (χ^2 = 18.704, p= 0.017, α=0.05). This means that educated farmers had confidence in using agricultural innovation as compared to the uneducated smallholder farmers.

Table 9

Education and Usage of Innovation

	Directional Measures	Value
Nominal by Interval Eta	Educational level	.248
	Innovation usage	.340

An eta value of 0.248 indicates a relatively weak relationship, suggesting that changes in education levels do not strongly correspond to the interval variable under consideration. In contrast, an eta value of 0.340 represents a moderate association between educational level and innovation usage, implying that education does have a noticeable, though not dominant, impact on innovation-related behaviors. This moderate eta suggests that while educational attainment provides some degree of predictability regarding a person's innovation usage habits, numerous other factors also influence these behaviors. The comparatively lower eta for education implies that the determinants of educational attainment are likely more complex and cannot be easily captured by the interval variable associated with innovation usage.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

The findings demonstrated that farmers utilized their knowledge and understanding to embrace and implement agricultural innovation in order to invest in their farming endeavors. Implementing agricultural innovation among farmers would enhance their farming practices in the research area. The findings revealed that 40% of the participants reported being aware of agricultural innovation through radio and television, while 10% reported being aware of agricultural developments through phone calls. According to the survey's findings, the majority of farmers indicated that they obtained agricultural knowledge on innovation mostly from their friends and relatives in the study area. Farmers indicated that they had benefited from the positive effects of agricultural innovations, provided they receive adequate support in terms of knowledge enhancement and access to information. The topic of addressing the obstacles related to agricultural innovation adoption among farmers was of great significance, as it determined the attainment of the desired advantages.

5.2 Recommendations

Awareness on the use of agricultural innovation was found to be low. More education and community engagement by the Extension officers to improve the knowledge of farmers would be ideal as this would go a long way to improve farmers adoption of agricultural innovation. Extension officers should increase their frequency of visits to farmers to enable them improve on their usage of innovation. The media especially in the study setting which is predominantly radio stations should be encouraged and supported by donor agencies and government to help provide opportunity for Extension officers by giving them free airtime to educate the public on the benefits of adopting agricultural innovations in the study setting instead of the aired programs

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